

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.



RECEIVED
★ OCT 9 1924 ★

UNITED STATES DEPARTMENT OF AGRICULTURE

DEPARTMENT CIRCULAR 323

Washington, D. C.

September, 1924

HOW TO COLLECT, LABEL, AND PACK LIVING PLANT MATERIAL FOR LONG-DISTANCE SHIPMENT

B. T. GALLOWAY

Office of Foreign Seed and Plant Introduction, Bureau of Plant Industry

CONTENTS

| | Page | | Page |
|---|------|--|------|
| Introduction..... | 1 | Bulbs, rootstocks, roots, and rhizomes..... | 8 |
| Dangers to be avoided..... | 1 | Cuttings, scions, and buds of soft-wooded plants..... | 9 |
| Importance of proper records..... | 2 | Rooted plants..... | 9 |
| Packing dry and dormant seeds..... | 2 | Sphagnum-moss method of growing plants for shipment..... | 10 |
| Packing and shipping nuts..... | 3 | Special shipping directions..... | 10 |
| Packing fruit-tree and related seeds..... | 4 | How to address packages..... | 11 |
| Tropical seeds..... | 4 | A last word of caution..... | 11 |
| Citrus-plant material..... | 6 | | |
| Cuttings and scions of dormant wood..... | 7 | | |
| Buds of hard-wooded plants..... | 8 | | |

INTRODUCTION

Seeds, plants, scions, grafts, and other plant material intended for propagating purposes may be shipped long distances if properly selected and packed. Long sea voyages through the Tropics are particularly severe on plant material, so that great care must be exercised where such journeys are involved.

The following suggestions and recommendations are based on several years' observation and experiments incident to the work of the Office of Foreign Seed and Plant Introduction. Shipments of plant material come from all over the world, packed in many different ways by many different people. Opportunities have therefore been afforded for conducting numerous experiments, cooperating in this work with agricultural explorers and others in different parts of the world.

DANGERS TO BE AVOIDED

The greatest danger involved in the shipment of living plant material is that of introducing some new insect pest or plant disease. Alien enemies already introduced are causing millions of dollars loss annually, and it behooves us to take every precaution against

bringing new ones to our shores. To guard against their entrance, the Department of Agriculture, through the Federal Horticultural Board, has developed an elaborate system of quarantine and inspection. Everything in the way of plant material brought in by the Office of Foreign Seed and Plant Introduction from remote or little-known regions is rigidly inspected and held, if necessary, until it is certain that all potential dangers have been removed. It is highly important, therefore, in selecting material for the use of the department that it be clean. Clean plant material and clean seeds will go far in assuring safety during a long journey and will remove many of the hazards incident to rigid inspection and the necessary treatments that must be given if the material is found to be infested with insects or affected with some serious disease. One of the functions of a plant introducer, however, is to meet these difficulties and to overcome them, for we must continue to bring in new crop plants if our agriculture is to be maintained on a satisfactory permanent basis.

IMPORTANCE OF PROPER RECORDS

Labels or marks of identification are of very great importance in all shipments of plant material. Whenever practicable, each package should be provided with two labels, one on the inside and one on the outside. The label should give (1) both the common and botanical names of the plant if possible, (2) place where collected, (3) date of collection, and (4) name of collector. When the botanical name of a plant is not known, the common or local name often gives a clue to its botanical name and proves useful in determining the best way to handle the material. A name often opens the way to other facts which may prove extremely helpful in handling the material and determining where to place it to the best advantage.

The Office of Foreign Seed and Plant Introduction has developed a thorough system of recording every plant introduction made by individuals through the Government. It is highly important that these records be as complete as practicable. Collectors are therefore urged to send in by mail as full a description of the plant, its uses, methods of culture, etc., as it is possible to secure. Photographs are always helpful and will enable the department to handle satisfactorily new plant immigrants. These descriptions are published, and full credit is given to every introducer of a new plant. The Office of Foreign Seed and Plant Introduction has already published 72 inventories, covering something over 5,800 pages, containing descriptions of plant material sent in.

PACKING DRY AND DORMANT SEEDS

Dry and dormant seeds, such as soybeans, cowpeas, ordinary beans, and peas; cereals, including wheat, oats, barley, rye, maize, and rice; also all dry vegetable seeds, like lettuce, cabbage, and melons of all kinds, are comparatively easy to handle, especially if packed in small lots. It is important that the seeds be fresh, clean, free from weed seed and trash, and thoroughly dry before packing. One of the best methods of packing these seeds is to place them in strong cotton sacks. Suitable sacks in pint, quart, 2-quart and 4-quart sizes are furnished by the Office of Foreign Seed and Plant Intro-

duction or may be made from strong cotton-cloth material. Place only one kind of seed in a sack, put one label containing the required data on the *inside* of the sack, and fasten the sack securely. If this small individual sack is to make a long sea journey, wrap it in two or three thicknesses of newspaper, tying with a string, then rewrap in oiled paper or heavy manila paper previously dipped in melted paraffin. These precautions are necessary to exclude moisture, which is very likely to destroy the viability of the seed on a long sea voyage. Put the duplicate label under the string used in tying the oiled paper or paraffin paper. It is best to write the labels on good, smooth, strong, white paper, using a common lead pencil. Do not use ink or indelible pencil. Ink is liable to blur if moistened, and the same is true of indelible pencils. A small bag wrapped as suggested above may be considered the unit packet. Directions for assembling these unit packets into larger packages (see Pls. I and II) or forwarding them singly will be found under "Special shipping directions." Where a number of the small sacks are to be assembled into a larger bundle, it is not necessary to wrap each sack individually in oiled or paraffined paper. It is desirable to put emphasis on the wrapping in oiled or paraffined paper, for it is found that seeds passing through the Tropics quickly lose their germinating power if subjected to changes in humidity, due to the lack of a proper moisture-preventive covering.

Seeds of beans, corn, wheat, rice, and related crops coming from warm countries are liable to be infested with weevils. To avoid this, it is advisable to give the seeds a 24-hour treatment with carbon bisulphide prior to packing. Carbon bisulphide is common and cheap throughout the world and can be found in almost any drug store or apothecary shop. Put the little packages of seeds while still in the cotton sack in a tin pail having a good tight lid or in a tight box of any kind. A pail or box holding 6 or 8 quarts will answer for most lots of seed. Pour an ounce of carbon bisulphide on a piece of cotton batting and lay this on top of the seed. Fasten the lid and leave for 24 hours. The carbon bisulphide is destructive of insect life but is not injurious to the seed.

PACKING AND SHIPPING NUTS

Certain nuts, including hickory nuts, walnuts, filberts, peanuts, and pecans, maintain their viability for considerable periods and may, therefore, be handled and packed as described for dry seeds. Other nuts, like chestnuts and acorns, are more or less short lived and must be handled carefully. Nearly all acorns and chestnuts coming from the Orient are liable to be infested with the larvæ of various species of beetles. The best method of forwarding such material is to pack it in tight boxes, either cracker tins or stout wooden boxes, using dry coarse charcoal and dry sifted sphagnum moss as packing material. (See Pl. III.) The moss and charcoal should be mixed in about equal quantities by bulk. If sphagnum moss is not available, use charcoal alone or charcoal and ground coconut fiber. (Pl. III.) The last material is commonly called "coir." The charcoal should be coarse, that is, in pieces one-eighth to one-fourth of an inch in size. After making sure that the acorns or chestnuts are fresh and that they do not show weevil holes, a layer of the packing

material should be spread on the bottom of the box. Scatter the nuts evenly over the surface of the material, allowing an inch or more around the edges for packing purposes. Then add another layer of packing material, shaking the box slightly to settle the seeds and packing material in place. Proceed in this way until the box is full, making sure that there is a good layer of packing material on top. When the boxes are packed, tie firmly and wrap in paraffined paper, then strong wrapping paper, and finally cover with cotton cloth, sewing the cloth on. Cotton bags are used for this purpose, doubling over the ends and sewing firmly. Label as directed for dry seeds. The need of sewing on the covers is emphasized, rather than depending on wrapping and tying with string. Packages that have been tied usually reach the department in bad shape. The addressed label should be sewed on the package.

PACKING FRUIT-TREE AND RELATED SEEDS

Fruit-tree seeds, including pear, apple, cherry, peach, persimmon, and many kinds of hard palm seeds, are likely to dry out unless carefully packed. Charcoal is one of the best materials for packing such seeds. If the charcoal is dry and dusty, add a very little water or steam it for half an hour over a bucket of boiling water. See that the charcoal is not too fine. It should be granular, not powdery. These seeds should be labeled as required for dry seeds, such as beans and peas. They may be packed in boxes, either tin or wooden, always with sufficient charcoal to keep the seeds well separated. It is a safe procedure to add about twice as much charcoal by bulk as seed—that is, if packing 1 pint of seeds, at least 2 pints of charcoal should be used. The smaller seeds may be mixed thoroughly with charcoal before packing. Certain of these seeds, like the peach, cherry, and plum, may be shipped dry in bags or boxes without charcoal or other packing. If desired, strong cloth bags may be used for such seeds. If the bags are small and they are going forward by sample or parcel post, they should be firmly tied, and after wrapping first in newspaper they should be wrapped in one or two thicknesses of good oiled paper. If the unit bags are quite small, they may be brought together and made into larger packages with the cotton covering sewed on, as described for other seeds. (See illustration of improper packing, Pl. II.)

TROPICAL SEEDS

Tropical seeds are among the most difficult seeds to ship long distances. This is particularly true of the lychee, longan, cacao, mangosteen, mango, and seeds of many palms. The avocado is not so difficult to ship. This seed, being large and almost woody, ships comparatively easily. One of the best methods of making certain the safe transportation of lychee and longan seeds is to ship the fruits containing the seeds. The fruits, if properly packed, will stand four or five weeks' travel. They carry best in fine, dry, sifted sphagnum moss, sifted coconut fiber, or coir, to which has been added a little coarse charcoal. It is not necessary that any of this material be wet or even damp. There is enough moisture in the fruit to serve all practical purposes for successful transportation. Allow

enough packing to keep each fruit and each layer of fruits well separated.

Fruits of this nature may be packed in small wooden or tin boxes. The wooden boxes, if sufficiently strong, will need no additional protection. Tin boxes, however, especially if the tin is thin, should be wrapped in several thicknesses of heavy newspaper, then in strong manila paper, and finally covered with a cotton bag sewed on.

Cacao seeds are soft and ferment and mold very easily. To be certain of their viability they must be gathered when fully mature and packed immediately. Coarse charcoal is the best packing material for them. Some of the best results in forwarding these seeds have been secured through sending the entire cacao pod without breaking or mutilating it in any way. The pod contains numerous seeds, and as a rule there is sufficient moisture in it to bring the seed through in fairly good shape. The pods, often measuring 4 to 6 inches in length, should be packed in coarse charcoal, using either strong wooden or tin boxes as carriers. It is the practice of the growers of cacao to forward pods containing seeds after dipping the pods in paraffin. No advantage has been found in this treatment; in fact, paraffined pods seem more inclined to ferment than those not so treated. Plenty of charcoal should be used, in order to thoroughly surround the pod with the antiseptic material.

Of all the seeds in this list, those of mangosteen have proved the most difficult to handle. These seeds are short lived, and for this reason it is difficult to transport them any great distance. The difficulty of transporting the seeds and the fact that most of the usual methods fail in attempts to propagate the plant no doubt account in large measure for its rarity and limited distribution. The mangosteen is one of the most delicious and highly prized tropical fruits. Many attempts have been made to establish it in some of our tropical regions, but with the exception of a few scattered trees there are no plantings of mangosteens on this continent.

The following specific instructions are offered for the securing, handling, packing, and shipping of seed of this fruit, in the hope that with the directions closely followed sufficient live plants may be secured to establish plantations of the trees in our tropical possessions.

Gather and select fully matured and perfect fruits and have everything ready for packing the seeds as soon as they are cleaned and dried. The seeds will dry in a few minutes, and drying should be done very carefully and always in the shade. Be sure that the seeds are plump and sound. Many of the seeds while appearing good are liable to be aborted and will ferment and sour when packed. Coir dust is the best packing material to use. This is nearly always available in the Tropics, where the mangosteen grows. Charcoal may be used, though it is not recommended unless coir dust is unavailable. The best receptacles for packing are small wooden or tin boxes such as are commonly used throughout most parts of the world for wafers and biscuits. These boxes usually measure 8 by 4 by 4 inches to 10 by 5 by 5 inches. The coir dust should be slightly moistened, and this is one of the difficult features of the procedure. Ordinarily steaming the coir dust for a few minutes or holding the receptacle containing the dust over boiling water for a short time will moisten

it sufficiently for all practical purposes. It is best in all cases to moisten the dust several hours or several days before it is to be used. Freshly moistened dust is never so good as that which has stood for 24 to 48 hours. With fresh, clean seeds at hand the coir dust should be spread over the bottom of the box to a depth of half to three-fourths of an inch. A layer of seed may then be placed on top of the packing material and another layer of dust added. This process should be continued until the box is filled. The top layer of coir dust should be rather thick. It is important that the seeds should not come in contact with each other. Good packing requires about twice as much material by volume as there are seeds. When the box is sufficiently packed it should be shaken carefully, in order to have the packing material fill up all the spaces. Fasten the lid of the box firmly, wrap in two or three thicknesses of oiled paper, then strong manila paper; then sew on a cloth covering, as described for other seeds. Follow the same plan of labeling as suggested elsewhere.

Another method of packing mangosteen seed should also be followed in order to make certain of successful shipment. By this method the seed is pregerminated; that is, it is made to sprout slightly before packing. It has often been observed that mangosteen seeds arriving from the Orient are slightly sprouted. In such cases fermentation and molds have not attacked the seeds. This suggested the idea of allowing the seeds to sprout slightly before packing. Freshly gathered seeds may be placed in coir dust, coconut fiber, or other suitable material for sprouting, and upon the first appearance of sprouts, which under normal conditions will be in 15 to 20 days, the seeds should be carefully lifted and packed as described above. Packed sprouted seeds grow very little as long as they are in tight boxes, but when removed from the boxes and placed in soil or other suitable material they grow quite rapidly.

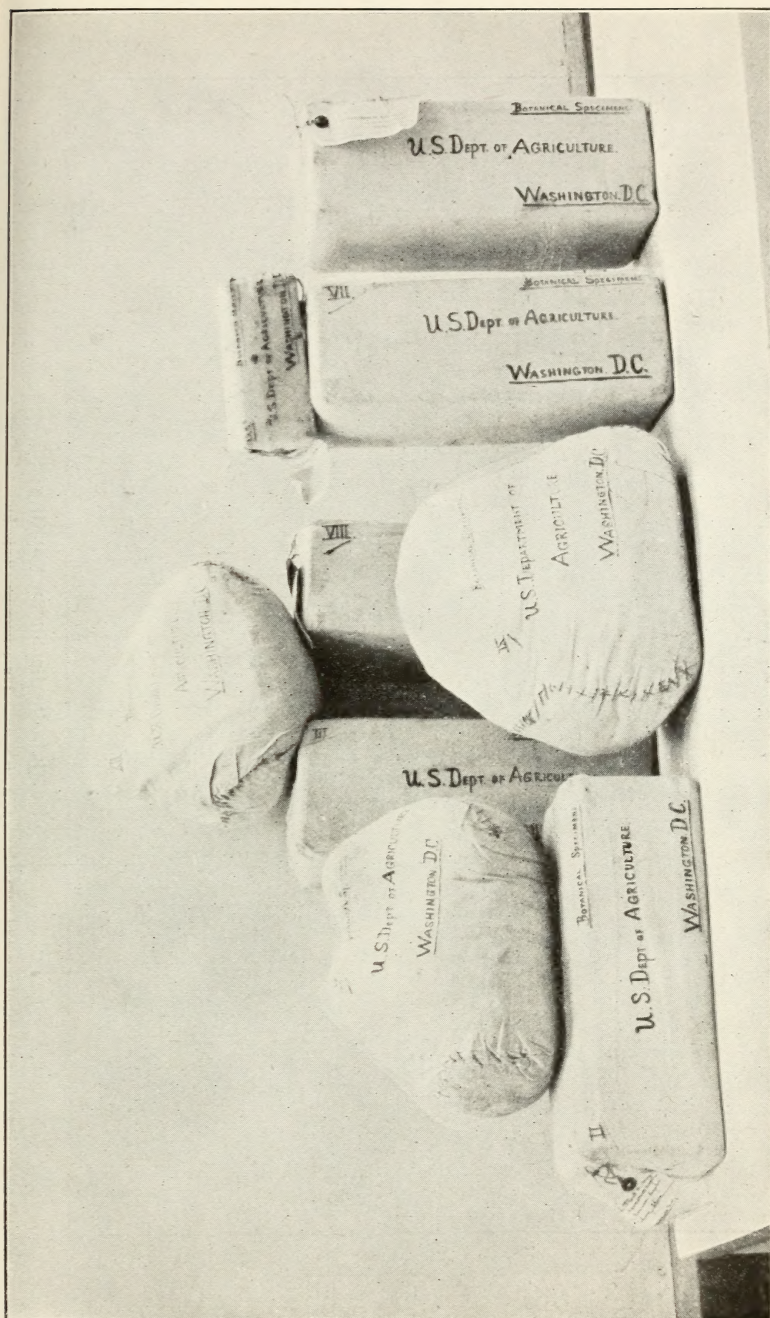
Mango seeds need careful handling. They are covered with a fibrous coat to which the flesh of the fruit clings tenaciously. The seeds should be scraped clean and then washed. After drying in the shade they should be packed in dry charcoal or dry coir dust, about as described for the mangosteen.

Avocado seeds may be packed in cut-up straw, fine shavings, sawdust, rice hulls, or grain chaff. Large lots, if going forward by express, may be packed in wooden boxes, using ordinary straw or excelsior for packing material. The chief point to observe in packing these seeds is to fill in sufficient packing material to prevent bruising and drying out. Label and mark as described for other seeds.

CITRUS-PLANT MATERIAL

Extra precautions must be followed in the handling and shipping of citrus seeds and other citrus-plant material. The disease known as citrus canker must always be kept in mind, and for this reason such material should always be packed alone and never combined in the same package with other plants or seeds. Citrus seeds, scions, and other propagating parts are subject to rigid inspection and quarantine; hence the importance of separate packing, handling, and marking. Citrus seeds deteriorate rapidly when exposed to the air. If taken fresh and not allowed to dry out, then packed immediately

600



WELL-PACKED PLANT MATERIAL FROM EASTERN CHINA

A shipment of plant material packed by Frank N. Meyer, Agricultural Explorer. Note the cotton coverings sewed on



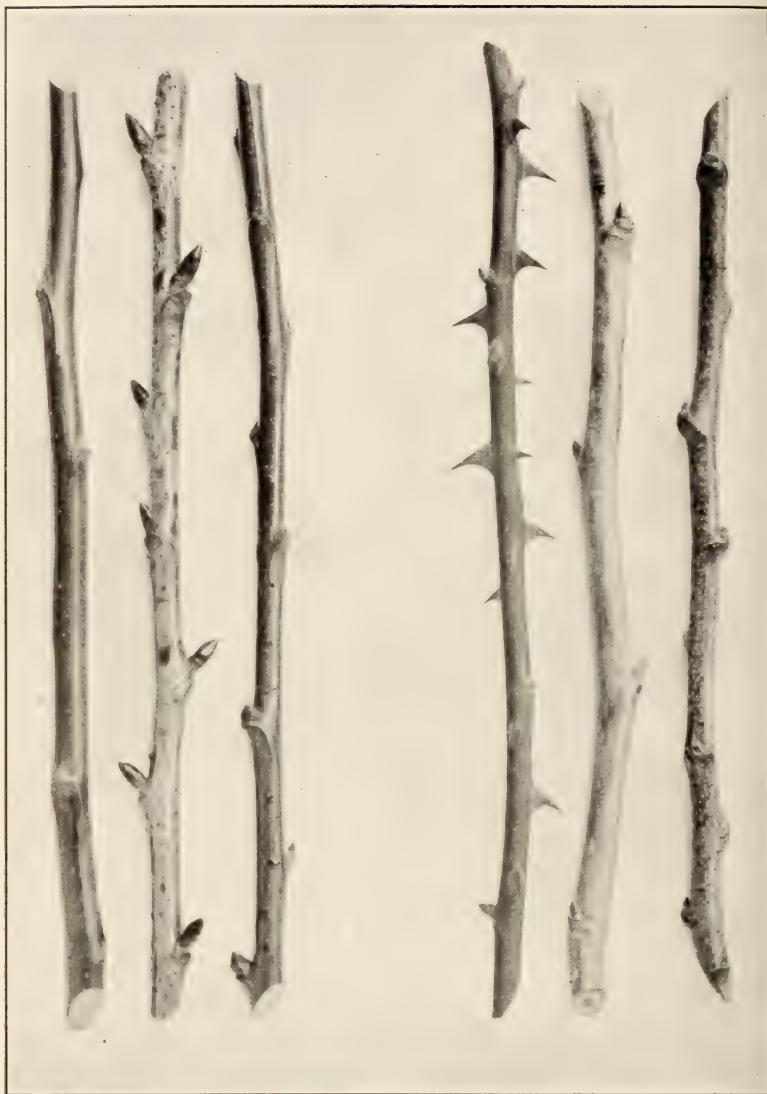
RESULTS OF IMPROPER PACKING

A poorly packed shipment of new and valuable seeds from Siam. These packages had a long, hard journey, and most of the seeds died en route



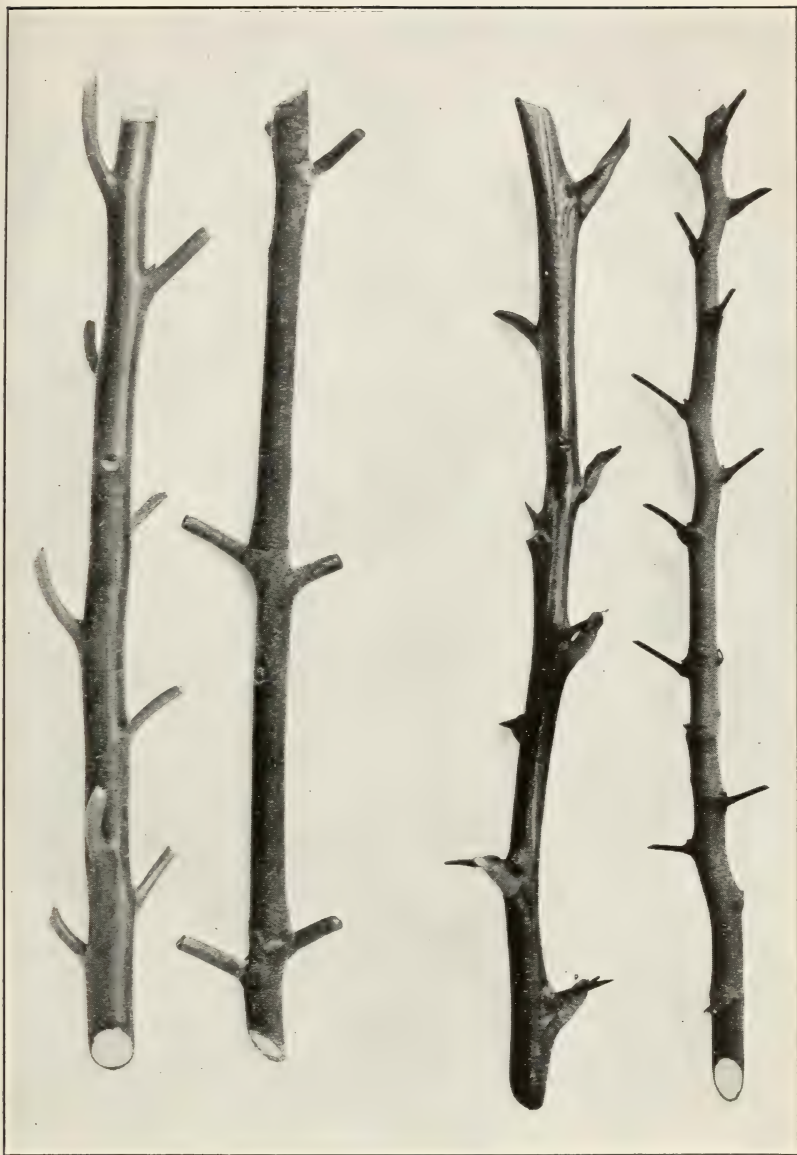
PACKING MATERIALS

Materials used in packing seeds and plants. Left to right: Coarse sphagnum moss, granular charcoal, coir dust, sifted sphagnum moss. (Natural size)



SCIONS OF HARD-WOODED PLANTS

From left to right: Chestnut, cherry, plum, rose, pear, and apple scions in good condition for packing by the wet-burlap method. (About two-thirds natural size)



BUD STICKS OF SOFT-WOODED PLANTS

From left to right: Avocado, mango, orange, and lychee bud sticks ready for packing. (About two-thirds natural size)



MATERIALS USED IN PACKING

Materials used in the wet-burlap method of packing. Left to right: Bundle of scions, scions wrapped in waxed paper, wet burlap added, in waxed paper again, dry burlap tied on, in tin tube, package completed ready for mailing



PACKING "BALLED" PLANTS

A foreign parcel-post shipment, showing the method of packing after plants are "balled"
in sphagnum moss



A SIMPLE AND CONVENIENT SHIPPING CRATE

Mango plants grown in boxes made of cypress shingles. This crate is excellent for shipping plants by express or freight



INTERIOR OF THE CRATE SHOWN IN PLATE VIII

The cheesecloth protection has been removed to show the method of fastening plants in the crate



COMPARISON OF SOIL AND SPHAGNUM MOSS FOR GROWING PLANTS FOR SHIPPING

Avocado plants grown in soil and in sphagnum moss. The three plants on the left were grown in soil and the three on the right in moss. Weight of plants in soil, 7 pounds 12 ounces; weight of plants in moss, 4 pounds 4 ounces. Note the superior root system of the plants grown in moss

in sifted coconut dust (coir) or sphagnum moss, they carry very well. Small tin or wooden boxes should be used for this purpose. The coconut dust and moss must be dry. The mistake is nearly always made of wetting this material. This is unnecessary, as it will gather enough moisture in transit to save the seed. The only danger is that the moss or coconut dust when exposed to atmospheric conditions in the Tropics will be too wet on account of the absorption of moisture. As a rule, however, such material will dry out sufficiently in a living room to answer all practical purposes.

CUTTINGS AND SCIONS OF DORMANT WOOD

Many hard-wooded plants, such as the apple, pear, plum, peach, cherry, persimmon, walnut, and other fruits, also many ornamentals, including the rose and other shrubs and trees, are propagated by means of scions and cuttings (see Pls. IV and V). Such material when properly selected and packed may be shipped long distances without difficulty. In selecting material of this kind for shipment care must be taken to see that it is free from scale insects, canker spots, or diseases of any kind. It is highly important, furthermore, that the wood shall be entirely dormant when packed. See to it that the wood is firm and plump and that it contains well-formed, good, strong buds. Experience has shown that cuttings and scions of dormant wood taken in the spring, even if not pushed at the time, are likely to start when placed in a warm, moist atmosphere. Cuttings at this period are in a state of unbalanced equilibrium and when packed and shipped long distances are liable to reach their destination with buds so badly pushed that it is impossible to make them live. If practicable, therefore, dormant wood should be sent during the late fall and early winter rather than in the spring.

A convenient length for scions of most of the plants above mentioned is 10 to 12 inches (Pls. IV and V). The size will vary somewhat with the plant itself. Pear, peach, cherry, plum, and similar scion wood in order to give good, strong buds should be about the size of a lead pencil. The accompanying illustrations show such scions and will give an adequate idea of their size and shape.

In cutting scions when the weather is cold or dry, they should be protected by a temporary wrapping of burlap or some similar material. Scions may be made up in bundles, the size of the bundles varying with the kind of material and the distance to be shipped.

For many years the standard material for packing such scions has been sphagnum moss (Pl. III). This has many excellent qualities, but for packing small lots of scions, cuttings, budwood, and perishable seeds, like chestnuts and acorns, it is very difficult to describe just how to wet the moss properly. A great many shipments, even when carefully packed under specific directions, arrive either too wet or too dry. The need of some simple method which could be easily described and followed without danger of overwetting or drying out has long been felt. Indications point to the discovery of such a method, which is called the wet-burlap method of packing (see Pl. VI).

Attention was first called to a form of this method by J. E. Morrow, Superintendent of the Plant Introduction Garden at Chico.

Calif. Mr. Morrow stated that he had learned of the method from the Washington Nursery Co., Toppenish, Wash. The Washington Nursery Co. was written to for information as to the origin of the method, and a reply was received indicating that they had not used it. Several changes have been made in the method as suggested by Mr. Morrow. Briefly, it consists in making up a bundle of scions of the proper size, taking care that the material is not allowed to dry out while being collected. The bundle is first wrapped in several thicknesses of waxed or oiled paper; next, it is wrapped in several thicknesses of common burlap which have been dipped in water and the water wrung out; following this another wrapping of waxed paper is put on, and finally a wrapping of dry burlap is added. The bundle is then firmly tied with string and slipped into a tin tube made for the purpose (see Pl. VI). If a tube is not available, a good tin or wooden box may be used. The box should have a tight lid. After packing the tube or box it may be sewed in a cloth bag and shipped as other packages are shipped (see the illustration of prepared packages, Pl. I). Numerous experiments in shipping dormant scions and other plant material have been made with the wet-burlap method. So far, all are very promising. Mango wood kept on the road for 55 days, going into the Tropics and back, was found to be in good condition. Apple and pear wood has been shipped to Australia and Java, involving 6 to 12 weeks on the road, and has arrived in excellent condition. Altogether the method is the most promising one so far discovered for the kind of wood here described.

BUDS OF HARD-WOODED PLANTS

Many plants, and especially the stone fruits, also the rose and other ornamentals, are propagated by budding. The operation is usually performed during the growing season; hence the buds must be shipped at that time. Budwood, being soft and in a growing condition as a rule, does not ship so well as dormant material. Budwood should be selected and handled with the same care as dormant wood. It should be free from scale and other insects and taken from healthy trees or plants. The leaves should be trimmed as soon as the branches are cut, leaving about half an inch of the petiole intact. To prevent wilting, the "sticks" containing the buds should be kept wrapped in wet burlap. Pack and label as described for hard-wooded scions, using the wet-burlap method. Four or five weeks is about the limit of time such material can be kept, under the best conditions of packing, handling, and shipping.

BULBS, ROOTSTOCKS, ROOTS, AND RHIZOMES

Nearly all of this material when collected at the proper season keeps well, and may be forwarded long distances quite readily if properly handled and packed. Bulbs come through in good shape if packed in fairly dry, fine, sifted sphagnum moss, coconut fiber, buckwheat hulls, grain chaff, or any material that will prevent bruising and too rapid drying out. (Pl. III.) In countries where it is difficult to secure the usual packing material, bulbs, rootstocks, and roots are sometimes packed in millet seed or similar seed, which may be easily

obtained. This is true of material coming from remote parts of China. Bulbs and roots going forward by parcel post pack best in small wooden or tin boxes, using about double the quantity of packing material by bulk as the space occupied by the bulbs. Rhizomes of bamboo and similar plants should be collected at the time when the plants are more or less dormant. Rhizomes half an inch in diameter and from 10 to 15 inches long, containing two or three good dormant eyes, are best for the purpose. Such material may be packed by the wet-burlap method, tying the bundles firmly and then sewing them in cotton cloth. Corrugated paper makes a good protective covering before putting on the cloth.

CUTTINGS, SCIONS, AND BUDS OF SOFT-WOODED PLANTS

Many soft-wooded plants, including the avocado, orange, lemon, grapefruit, mango, and lychee, although evergreens, are propagated by buds. (See Pls. IV and V.) Such plants are also frequently propagated by grafts. Material of this kind is rather difficult to ship and must be selected and packed very carefully. The wood of the mango and avocado should be well ripened but not too old. Much care should be exercised in selecting wood of these plants to avoid anything in the nature of insect infestation. Material for propagation had best be cut in lengths of 8 to 10 inches. The leaves should be carefully trimmed off, leaving spurred petioles as shown in Plate V. If the cutting is too soft, the buds are liable to wither and fail to push. On the other hand, if the wood is too old the buds may be slow in pushing, and in many instances they may not push at all. The best wood of mangos and avocados comes from branches 5 or 6 months old. Cuttings of lychee and longan are sometimes shipped, but as a rule it is difficult to get them to grow. Even when handled with great care, the buds refuse to push. Here, again, the wet-burlap method of packing is advised. A dozen good bud sticks of the orange, grapefruit, avocado, or mango will make a good shipping bundle, using tin tubes or tin or wooden boxes, as already described. (See Pl. VI.) Sew the packages in cotton cloth, as suggested for other materials. It is sometimes desirable to ship small lots of budwood, such as here described. Each of these lots may be packed by the wet-burlap method and the several bundles assembled into a large one, using first a covering of strong paper, preferably corrugated board, and finally a cotton covering sewed on. The illustrations (Pl. I) will make this method clear.

ROOTED PLANTS

Small rooted plants, especially deciduous ones, without soil on their roots may be shipped without difficulty when dormant (see Pl. VII). They should be packed in sphagnum moss, each lot or unit packet being wrapped in newspapers and oiled paper. These unit packets may be assembled in bundles or bales and covered with burlap sewed on. If there are a considerable number of smaller unit packets they may be packed in a strong box, using plenty of moss to keep the material in good condition. Getting the moss of just the right wetness is always a problem. The experienced packer can tell by the "feel" of the moss when it is right. He can not convey this

idea of "feel" to the inexperienced. Starting with dry moss it requires about a pint and a half of water to wet properly each pound of moss. The best way to wet the moss is to put it in a can or box and then sprinkle hot water on it. Put a tight lid on the receptacle and let the moss stand in it overnight.

It is inadvisable without special instructions to attempt to ship plants with soil on the roots. Such instructions will necessarily vary with the kind of plants to be shipped and the needs of the occasion. Balled plants with a lot of soil about the roots or loose in so-called Wardian cases are always sources of much danger. The Wardian case, a sort of small portable greenhouse, has probably been the means of scattering more dangerous insects, nematodes, and other pests over the earth than almost any other form of carrier; hence its use is not advised except under special instructions.

SPHAGNUM-MOSS METHOD OF GROWING PLANTS FOR SHIPMENT

Many of the dangers and difficulties of transporting small pot-grown plants may be overcome by a method which has been followed for a number of years. Ordinary sphagnum moss, such as is commonly used for packing, is made to serve the place of soil. No fertilizer whatever is added to the moss. Many kinds of plants thrive in this material, and when its cleanliness, lightness, and the ease with which such plants are packed and shipped are considered, the small extra labor involved in potting becomes negligible. A simple and convenient crate for shipping plants grown in sphagnum moss is shown in Plates VIII and IX. A comparison of the weights of moss and soil is of interest in this connection (see Plate X). A 2-inch pot of soil weighs approximately 3 ounces; 3-inch pot, 9 ounces; 4-inch pot, 1 pound 2 ounces; 6-inch pot, 3 pounds 12 ounces. Moss in the same sized pots weighs per 2-inch pot, 1 ounce; 3-inch pot, 2 ounces; 4-inch pot, 4 ounces; and 6-inch pot, 12 ounces.

The greatest factor in favor of the moss, however, is its freedom from insects and diseases. Inasmuch as no plants with balls of soil on the roots are allowed to come into the United States, owing to the risk of introducing dangerous crop pests, foreign growers may well turn their attention to the production of plants in moss, where this material is available.

SPECIAL SHIPPING DIRECTIONS

Seeds and plants may be shipped, if properly packed, by sample post, parcel post, express, or freight. For shipping by sample post or parcel post the unit packets already described should be assembled into proper-sized packages. A sample-post package must not weigh over 12 ounces (350 grams) and should not measure more than 12 by 8 by 4 inches (30 by 20 by 10 centimeters). The parcels may be covered with strong cotton cloth, sewed on as already described.

It will be best to write the address on the package rather than on a tag which must be tied on with string or wire. In the event that tags are used, sew them on the package.

Parcel-post packages may be put up in the same way. The limit of weight for parcel-post shipment is 11 pounds, and the allowable di-

mensions are as follows: Greatest length $3\frac{1}{2}$ feet and greatest length and girth combined $6\frac{1}{2}$ feet.

No packages should be shipped by express or freight without special instructions.

HOW TO ADDRESS PACKAGES

Linen tags bearing the proper return address will be furnished collaborators and others desiring to send seed or plant material to the Department of Agriculture. Where such tags are not at hand, address all packages: *U. S. Department of Agriculture, Bureau of Plant Industry, Office of Foreign Seed and Plant Introduction, Washington, D. C., U. S. A.* Write in the upper left-hand corner of the tag the name and address of the sender.

A LAST WORD OF CAUTION

It may seem unimportant to follow closely some of the directions herein given. So many failures and disastrous results have occurred from variations from the directions that the department feels compelled to urge that they be followed as closely as practicable in all cases. Neglect to *sew* cloth coverings on the packages properly may result in the total loss of valuable material. Leaving off the dry burlap wrapper and substituting newspaper therefor may cause the sweating and molding of a collection of valuable scions or budwood. Too much care can not be given to the selection of *clean, healthy* plant material. This country has an enormous tax to pay each year in the shape of losses resulting from some alien crop enemy that has found its way to our shores and now demands its toll in the way of diminished yields and destroyed crops. The citrus canker, now happily nearly overcome, the gipsy moth, the brown-tail moth, the San Jose scale, the white-pine blister rust, and scores of other enemies are here and are likely to give us trouble for some time. We do not want any more.

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

September 10, 1924

| | |
|--|--|
| <i>Secretary of Agriculture</i> ----- | HENRY C. WALLACE. |
| <i>Assistant Secretary</i> ----- | HOWARD M. GORE. |
| <i>Director of Scientific Work</i> ----- | E. D. BALL. |
| <i>Director of Regulatory Work</i> ----- | WALTER G. CAMPBELL. |
| <i>Director of Extension Work</i> ----- | C. W. WARBURTON. |
| <i>Solicitor</i> ----- | R. W. WILLIAMS. |
| <i>Weather Bureau</i> ----- | CHARLES F. MARVIN, <i>Chief</i> . |
| <i>Bureau of Agricultural Economics</i> ----- | HENRY C. TAYLOR, <i>Chief</i> . |
| <i>Bureau of Animal Industry</i> ----- | JOHN R. MOHLER, <i>Chief</i> . |
| <i>Bureau of Plant Industry</i> ----- | WILLIAM A. TAYLOR, <i>Chief</i> . |
| <i>Forest Service</i> ----- | W. B. GREELEY, <i>Chief</i> . |
| <i>Bureau of Chemistry</i> ----- | C. A. BROWNE, <i>Chief</i> . |
| <i>Bureau of Soils</i> ----- | MILTON WHITNEY, <i>Chief</i> . |
| <i>Bureau of Entomology</i> ----- | L. O. HOWARD, <i>Chief</i> . |
| <i>Bureau of Biological Survey</i> ----- | E. W. NELSON, <i>Chief</i> . |
| <i>Bureau of Public Roads</i> ----- | THOMAS H. MACDONALD, <i>Chief</i> . |
| <i>Bureau of Home Economics</i> ----- | LOUISE STANLEY, <i>Chief</i> . |
| <i>Bureau of Dairying</i> ----- | C. W. LARSON, <i>Chief</i> . |
| <i>Fixed Nitrogen Research Laboratory</i> ----- | F. G. COTTRELL, <i>Director</i> . |
| <i>Office of Experiment Stations</i> ----- | E. W. ALLEN, <i>Chief</i> . |
| <i>Office of Cooperative Extension Work</i> ----- | C. B. SMITH, <i>Chief</i> . |
| <i>Office of Publications</i> ----- | L. J. HAYNES, <i>Director</i> . |
| <i>Library</i> ----- | CLARIBEL R. BARNETT, <i>Librarian</i> . |
| <i>Federal Horticultural Board</i> ----- | C. L. MARLATT, <i>Chairman</i> . |
| <i>Insecticide and Fungicide Board</i> ----- | J. K. HAYWOOD, <i>Chairman</i> . |
| <i>Packers and Stockyards Administration</i> ----- | } CHESTER MORRILL, <i>Assistant</i> <i>to the Secretary</i> . |
| <i>Grain Futures Administration</i> ----- | |

This bulletin is a contribution from

| | |
|--|-------------------------------------|
| <i>Bureau of Plant Industry</i> ----- | WILLIAM A. TAYLOR, <i>Chief</i> . |
| <i>Foreign Seed and Plant Introduction</i> ----- | DAVID FAIRCHILD, <i>In charge</i> . |

12

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
5 CENTS PER COPY



